

## LEAD

## The Core of the Candle Problem

A romantic evening at home surrounded by candlelight may pose a not-so-romantic health hazard. Some candles made with metal wicks emit lead into the air when burned, finds a study by environmental chemist Jerome Nriagu of the University of Michigan in Ann Arbor, scheduled for publication in an upcoming issue of *Science of the Total Environment*. The dark, shiny metal wick cores are used to make the wick more rigid and to slow burning, and are thus more common in large, poured candles (such as pillar candles and those in glass containers) and those where a longer burning time may be especially desirable (such as scented candles).

Nriagu tested 15 different brands of candles with metal wicks that were purchased in Michigan stores. The candles were made in the United States, Mexico, or China, and they ranged in size from 3.5 to 7.0 centimeters in diameter and from 5.0 to 15.0 centimeters in height. The candles were burned in a combustion chamber for 2–4 hours, and the fumes were captured in a trap containing nitric acid, which dissolved the lead aerosols. The amount of lead in solution was measured using an atomic absorption spectrometer.

The six candles made in the United States released 1.1–66.0 micrograms ( $\mu\text{g}$ ) of lead per hour, the five Mexican candles released 0.5–5.9  $\mu\text{g}$  per hour, and the four Chinese candles released 1.8–327.0  $\mu\text{g}$  per hour. The amount of lead that would accumulate in a closed bedroom measuring about 12 feet by 15 feet by 10 feet, or 50 cubic meters ( $\text{m}^3$ ) in volume, after burning each candle for 2 hours was calculated. Lead concentrations in the room after 2 hours of burning were estimated at 0.04–13.1  $\mu\text{g}/\text{m}^3$ , in some cases far exceeding the U.S. Environmental Protection Agency's (EPA) ambient air quality standard of 1.5  $\mu\text{g}/\text{m}^3$ .

An earlier Australian study found that several large Chinese candles released lead amounts averaging 779.0  $\mu\text{g}$  per hour. Those results, published in the December 1999 issue of *Science of the Total Environment*, resulted in lead wicks being banned in Australia.

Lead aerosols released by burning candles may be deposited on walls, furniture, and floors. This deposition increases the likelihood that children may be contaminated through

hand-to-mouth activities. The central nervous system of children is particularly sensitive to lead poisoning. Chronic low levels of lead exposure cause learning disabilities, incoordination, and behavioral disorders. Lead also damages the heart, red blood cells, and digestive system. Overall, lead poisoning remains one of the most serious environmental health problems worldwide, especially among children.

Retail sales of candles in the United States grew during the 1990s at an average rate of 10–15% annually and reached \$2.3 billion in 1999. Although lead has been removed from gasoline, paint, plumbing, and pottery, candles represent a largely unrecognized source

of lead. "Lead wicks should be banned in every country," says Nriagu.

In 1973, the Health Research Group of the consumer rights organization Public Citizen unsuccessfully petitioned the Consumer Product Safety Commission to remove candles with lead-containing wicks from the market. The commission did ask candle manufacturers to replace lead with zinc. But compliance is totally voluntary and imported candles are not checked. Pure zinc poses no health risk, but commercial-grade zinc and alloys used in wicks usually contain lead, too.

About 85% of the 200 candle manufacturers in the United States belong to the National Candle Association, a Washington, DC-based trade group that promotes lead-free wicks. "If you buy candles made in the United States, chances are good it won't have any lead," says Marianne McDermott, executive vice president of the association. However, on 24 February 2000, Public Citizen released the results of a survey in which 285 candles available in 12 different chain stores in the Baltimore/Washington, DC, area were examined. Some 30% of the candles were found to have metal wicks. One of each of these candles was purchased, and the wicks were analyzed to determine their lead content. Nine of the candlewicks contained as much as 85% lead by weight. According to the group's calculations, burning such candles could yield ambient air lead concentrations that are 9–33 times higher than the EPA standard.

Public Citizen has once again petitioned the CPSC to immediately ban and recall all candles with lead-containing wicks, candles in metal containers that contain lead, and wicks sold for candle making that contain lead. In the meantime, to protect themselves, consumers should look for candles with cotton wicks. —Carol Potera

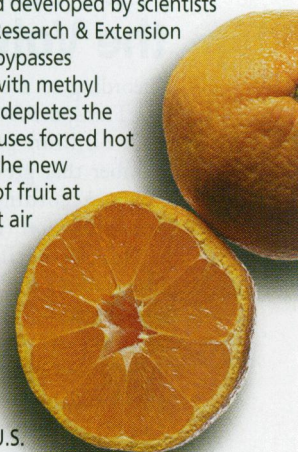


**Aroma-hazard.** Candles with metal wicks may emit large amounts of lead.

## Safer Citrus Is Hot

A citrus processing method developed by scientists at the USDA Agricultural Research & Extension Center in Weslaco, Texas, bypasses conventional fumigation with methyl bromide—a pesticide that depletes the ozone layer—and instead uses forced hot air to kill fruit flies. Using the new method, up to eight tons of fruit at a time is processed in a hot air chamber, where the fruit centers are quickly heated to 111°F and kept at that temperature long enough to kill any fruit flies inside.

The majority of the 1.18 million tons of citrus fruit exported in 1998 by U.S. distributors required fruit fly extermination treatments. The forced hot air treatment was approved by the USDA for grapefruit, tangerines, and Valencia oranges in 1998, and for navel oranges in 1999.



## Multiplying Microbials

Scientists from Wageningen University in the Netherlands and the University of Iowa have found that separating organic waste from other household waste can cause increases in microbial contaminants in house dust. Contaminants such as bacterial endotoxins, mold  $\beta(1\rightarrow3)$ -glucans, and fungal extracellular polysaccharides (EPSs) of *Aspergillus* and *Penicillium*, which were determined to be markers of microbial exposure, may increase the risk for bioaerosol-related respiratory symptoms in susceptible people.

The study, published in the February 2000 issue of *Applied and Environmental Microbiology*, found that when separated organic waste was stored for over one week, concentrations of endotoxins, glucans, and EPSs were 3.2-, 4.6-, and 7.6-fold higher, respectively, than in homes where only nonorganic waste was stored indoors. Separated organic waste stored indoors for less than one week increased endotoxin concentrations 2.6-fold and EPS concentrations 2.1-fold. Indoor storage of nonseparated waste was found to have no effect on concentrations of microbial agents.

## Backyard Dioxin

A report in the 1 February 2000 issue of *Environmental Science and Technology* warns that burning typical household waste in barrels may produce dioxin and furan levels higher than those emitted by municipal waste incinerators serving thousands of people. Dioxins and furans cause immune dysfunction, cancer, developmental abnormalities, and hormonal changes in laboratory animals, and are also a concern to human health.

Scientists from the U.S. EPA and the New York State Department of Health found that, under test conditions, more polychlorinated compounds were emitted from trash burned in barrels than from municipal incinerators. Burning household waste in open barrels is banned in most areas of the United States; areas in which it is permitted are mostly rural.